

SHORT REPORTS

Evaluation of Knowledge and Practice of Radiographers and Operating Room Personnel about Radiation Protection: Importance of Training Courses

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Abstract

Purpose: Awareness of personnel who are professionally involved with ionizing radiation on the principles of radiation protection is very important; especially for operation room personnel, because they do not receive radiation protection training during their university education in Iran. The aim of this study was to evaluate knowledge and practice of radiographers and operating room personnel about the principles of radiation protection.

Materials and Methods: A validated researcher-made questionnaire was used and the study was conducted on 328 medical staff in 2021. Factors such as age, gender, university degree, working years, occupation, and knowledge and practice about radiation protection were recorded. The collected data were analyzed by independent t-test and Pearson correlation analysis using SPSS software.

Results: The results of the study showed that age, gender and university degree have no significant effect on the knowledge and practice of radiographers and operating room personnel ($p > 0.05$). The knowledge and practice of radiographers were significantly higher than operating room personnel ($p < 0.05$). With regard to working years, there were significant relationships with the knowledge of personnel ($p = 0.034$), and with practice ($p = 0.038$). There was a significant correlation between passed training courses of radiation protection and knowledge ($p = 0.012$), and practice ($p = 0.033$). There was a significant correlation between knowledge about radiation protection and practice ($p = 0.002$).

Conclusion: It is necessary to encourage staff with lower working years and operating room personnel to participate in radiation protection courses and workshops. It can be suggested to add training programs about radiation protection in university education or in-service education for operating room personnel.

Keywords: Knowledge; Attitude; Practice; Ionizing Radiation, Radiation Protection.

1. Introduction

Radiation protection standards are based on three important principles: justification, optimization and dose limits. Increasing the knowledge about the effects of ionizing radiation highlights the principle of optimization [1]. Clinical experiences and previous researches show that knowledge of medical personnel about the principles of protection against ionizing radiation is insufficient [1-6]. A standard questionnaire can be used to assess the knowledge and practice of specialist physicians, radiologists, nurses, medical assistants, radiographers, and other hospital staff about the principles of radiation protection [4, 7].

Skin cancer, leukemia, dermatitis, cataracts, and other side effects have been observed in physicians, radiologists, and other health care workers and patients, years after the use of X-rays in diagnosis and treatment. Therefore, it was necessary to develop guidelines and recommendations to protect patients and staff from ionizing radiation [8, 9].

Radiographers and operating room personnel are those who deal with ionizing radiation because of their professions [10, 11]. In Iran, operating room personnel, working with the C-Arm fluoroscopy, do not receive radiation protection training during their university education. This necessitates assessing the awareness of operating room personnel about radiation protection. Radiation levels in diagnostic radiology fall into the category of stochastic effects, such as hereditary disorders and cancer risk, in which the effect is independent of the dose of ionizing radiation and has no threshold. This highlights the recommendations for radiation protection and the use of radiation protection equipment and instructions to protect both patients and medical personnel [12].

There are limited studies that provide knowledge and practice on radiation protection for different two groups in Iran, including radiographers who have received radiation protection training during university education and operating room staff who have not received radiation protection training during university education. Therefore, due to the destructive effects of ionizing radiation as well as the importance of knowledge of medical personnel about the principles of radiation protection, the researchers intend to evaluate the knowledge and practice of radiographers and operating room personnel about the principles of radiation protection in several hospitals and clinics. Finally, the collected data is used to change the training policies of optimizing the knowledge, attitude and practice

of health personnel to the principles of radiation protection. These changes include the formation of courses and workshops. These improve the knowledge and practice of personnel and familiarize them with the rules and organizations related to radiation protection.

2. Materials and Methods

In this study, a researcher-made questionnaire was used [2]. Based on the opinions of several medical physicists, the first draft of the questionnaire was prepared. The validity of the questionnaire was approved by several experienced medical physicists and biostatistics experts. Then, a pilot study was conducted among a sample of 20 radiology personnel to determine the reliability of the questionnaire. The two sets of responses (two weeks apart) were used to establish the reliability of the test by estimating the Pearson correlation coefficient showed the reliability of the acceptable scale ($r = 0.81$ and $p < 0.001$). The questionnaire had three sections. The first part provides demographic data, including age, gender, university degree, working years, occupation and passed training courses about radiation protection. It should be noted that the informed consent declaration was accommodated in demographic section. The second part provides information about personnel knowledge and included 26 questions, with score of zero and 1 assigned for incorrect and correct answer, respectively. The third part provides information about personnel practice and included 18 questions, with score of zero and 1 assigned for non-practiced and practiced options, respectively.

This study was conducted in several provinces in Iran, including Khorasan Razavi, Ahvaz, Qazvin and Alborz, and the purpose was evaluation of knowledge and practices of radiographers and operating room personnel about radiation protection. It should be noted that the operation room personnel included in this study were those who worked with C-arm fluoroscopy machine.

Our participants were selected from educational hospitals, non-educational hospitals and private clinics in different cities. The questionnaire was designed to assess the respondents' knowledge about the need to use protective equipment and their practice in implementing the principles of radiation protection. 400 copies of the questionnaire were distributed among staff. The response rate was 82%, i.e., 328 persons completed questionnaires. In this study, the

researchers recorded factors such as age, gender, university degree, working years and occupation. The collected data were plugged into SPSS software and analyzed. For data analysis, independent t-test and Pearson correlation analysis were run.

3. Results

Among the 328 participants in this study, 183 (55.8%) were female and 145 (44.2%) were male. In terms of working years, 229 participants (69.8%) had working years less than or equal to 15 years and 99 participants (30.2%) had working years over 15 years. From the point of view of university degree, 284 personnel have a bachelor's degree (86.58%), and 44 personnel have a master's degree (13.41%). Occupationally, 172 (52.44%) of the participants were radiographers, 156 (47.56%) of the participants were operating room personnel. 124 (37.80%) of all medical personnel declared that they had passed at least one training course of radiation protection. Table 1 shows the percentage of personnel's knowledge about the principles of radiation protection

for different variables. According to Table 1, there is no significant relationship between gender and the knowledge of personnel about the principles of radiation protection ($p=0.657$). There is no significant relationship between the university degree and knowledge of the personnel ($p=0.607$). With regard to working years, there was significant relationship with the knowledge of personnel ($p= 0.034$), so that, personnel with working experience equal and less than fifteen years (61.1 ± 7.4) had less knowledge than personnel with more than fifteen years of experience (70.9 ± 8.8). Also, there was a significant relationship between personnel's occupation and knowledge about the principles of radiation protection ($p=0.016$), so that the knowledge of radiographers (75.2 ± 7.1) was higher than operation room personnel (47.2 ± 7.6).

Table 2 shows the percentage of personnel's practice about the principles of radiation protection with different variables. According to Table 2, there is no significant relationship between gender and the practice of personnel about the principles of radiation protection ($p=0.692$). There is no significant relationship between the university

Table 1. Percentage of personnel's knowledge about the principles of radiation protection for different variables

Variables	Characteristic	N	Mean Score (%)	SD	P-value
Gender	Male	145	65	11.2	0.657
	Female	183	63.5	15.8	
University Degree	bachelor's degree	284	59.5	3.5	0.607
	master's degree	44	62.1	15	
Working Years	≤ 15	229	61.1	7.4	0.034
	>15	99	70.9	8.8	
Occupation	Radiographer	172	75.2	7.1	0.016
	Operating room personnel	156	47.2	7.6	

Table 2. Percentage of personnel's practice about the principles of radiation protection

Variables	Characteristic	N	Mean Score (%)	SD	P-value
Gender	Male	145	58.4	9.1	0.692
	Female	183	56.5	11.1	
University Degree	bachelor's degree	284	56.7	10.3	0.44
	master's degree	44	53.9	9.4	
Working Years	≤ 15	229	57.5	3.4	0.038
	>15	99	65.1	2.2	
Occupation	Radiographer	172	72.5	4.3	0.001
	Operating room personnel	156	44.8	8.9	

degree and practice of the personnel ($p=0.44$). With regard to working years, there was significant relationship with the practice of personnel ($p = 0.038$), so that, personnel with working experience equal and less than fifteen years (57.5 ± 3.4) have lower practice than personnel with more than fifteen years of experience (65.1 ± 2.2). Also, there is a significant relationship between personnel's occupation and practice about the principles of radiation protection ($p=0.001$), so that the practice of operating room personnel (44.8 ± 8.9) was lower than radiographers (72.5 ± 4.3).

Table 3 represents the results of correlations between different variables. There was no significant correlation between knowledge and age ($p=0.083$). There was no significant correlation between practice and age ($p=0.079$). There was significant correlation between passed training courses of radiation protection and knowledge ($p=0.012$), and practice ($p=0.033$). There was significant correlation between knowledge about radiation protection and practice ($p=0.002$).

Table 3. Results of correlations between different variables

Variables	Age	Passed Training Courses	Practice
Knowledge	$p=0.083$	$p=0.012$	$p=0.002$
Practice	$p=0.079$	$p=0.033$	-

4. Discussion

In this study, the researchers tried to evaluate the knowledge and practice of 328 radiographers and operation room personnel about radiation protection principles. Several studies have been conducted on occupational exposure to radiation and radiation protection awareness. Regarding the effect of age on personnel knowledge, Rezaei Kahkhaei *et al.* study showed a relationship between age and radiation protection knowledge of operating room personnel, so that with increasing age, the level of knowledge increased [13]. The present study showed that the age of the personnel has no effect on their knowledge about the principles of radiation protection. Regarding the effect of gender on personnel knowledge about the principles of radiation protection, the study of the Kargar *et al.* [14] and Shabani *et al.* [1] showed that the gender of personnel has no effect on the knowledge of radiographic personnel.

In accordance with the mentioned studies, the present study showed that the gender of personnel does not affect their level of knowledge about the principles of radiation protection. Regarding the effect of the university degree, the study of Kargar *et al.* [14] reported that the knowledge of the radiographic staff with a master's degree on the principles of radiation protection was higher than that of staff with a bachelor's degree. Also, Hirvonen *et al.* [15] physics and the principles of radiation protection, reported that the knowledge of nurses with a master's degree is higher than nurses with a bachelor's degree, indicating that the university degree had a positive effect on the level of in a study on the level of nurses' knowledge of radiation radiation protection knowledge. In our study, the university degree had no effect on the level of knowledge about the principles of radiation protection. This is predictable for operating room staff because they do not have a radiation protection course in either undergraduate or graduate courses, but for radiographers more investigations are needed. Therefore, it can be concluded that training courses on the principles of radiation protection should be held regularly, regardless of the level of the university degree. In our study, with regard to working years, the personnel whose years of work were more than fifteen years, their level of knowledge were higher than other personnel, which is consistent with Shafiee's results [16]. This may be due to the participation of staff with longer working years in more training workshops. The present study showed that the knowledge of radiographers was higher than operating room personnel, which may be due to the passed training courses related to the principles of radiation protection in university education. The low knowledge level of operating room personnel necessitates holding radiation protection workshops, as significant correlation observed between knowledge and passed training courses.

One study has shown the effect of gender and working years on the level of practice of personnel on the principles of radiation protection, so that the level of practice of male and staff with working years more than 15 years was more than others [17]. Another study [13] showed that gender affects the level of personnel practice in applying the principles of radiation protection, so that the practice of female staff is better than male staff. In the present study, age, gender and university degree had no effect on personnel practice. However, working years is very effective on the level of personnel practice to the applied principles of radiation protection,

so that the staff with higher working years had better practice, which may be related to their higher knowledge level and more work experience. Also, radiographers' practice level was better than operating room personnel, which may be due to their more knowledge level about radiation protection. Low mean score of practice of operating room personnel (44.8) may be related to their lower knowledge about radiation protection, as significant correlation was observed between knowledge and practice. Also, significant correlation between practice and the passed training courses necessitates passing radiation protection courses for operating room personnel. Significant relationship between radiation protection educational programs highlights the importance of radiation protection training. This study showed that with the increase of working years, participation of personnel in in-service retraining workshops increased, which improved the level of knowledge, attitude and practice of personnel about the principles of radiation protection. Therefore, it is necessary to encourage staff with lower working years and operating room personnel to participate in radiation protection courses and workshops.

5. Conclusion

The results of the study showed that age, gender and university degree have no effect on the knowledge and practice of radiographers and operation room personnel. Working years and occupation have effect on the knowledge and practice of radiographers and operation room personnel. It is necessary to encourage staff with lower working years and operating room personnel to participate in radiation protection courses and workshops. It can be concluded that it is better to add training programs about radiation protection in university education or in-service education for operation room personnel.

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